

Some Aspects of the Behavior of the Blennioid Fish *Chaenopsis ocellata* Poey¹

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(Plates I-III; Text-figure 1)

INTRODUCTION

THREE individuals (two males and a female) of *Chaenopsis ocellata* Poey, the pike blenny, were captured during January, 1958, and were placed in an aquarium. Studies were conducted both at The Marine Laboratory and the Miami Seaquarium. During the course of the study the two males were killed by crabs inadvertently introduced into the tank, but each was replaced within a few days. One male measured 73 mm. in standard length; the other males were about the same length and the female was about 10 mm. smaller. Detailed notes were recorded at irregular intervals for six months and more casual observations were made nearly every day.²

Longley (Longley & Hildebrand, 1941: 275) described *C. ocellata* in some detail and recorded some aspects of its life history. However, certain details of coloration pertinent to the present study were not noted. The dorsum is sand-colored and is crossed by a variable number of dark bars which merge into the very dark sides. Although our specimens were kept in dark-bottomed aquaria and then on pale sand for many weeks, no change was seen in the sharp contrast between the pale dorsum and the dark sides. This

differs from the account of Longley & Hildebrand (1941:275). Perhaps *C. ocellata* is another example of a background-contrasting species (see Breder, 1949: 93-94), but more likely the ability to change its general coloration has been lost as a consequence of life in tubes and holes. As noted below those features of *C. ocellata* that change are anterior on the body, i.e., on the portion normally exposed.

Males have the spinous portion of the dorsal fin dusky, the color intensified when the fish is disturbed. A prominent black comma-shaped mark is present on the membrane between the first two dorsal spines. In larger males the black mark is bordered on the first spine by an azure streak. The black comma partially encloses an orange spot and in some individuals the two are separated by a white streak (Plate II, Figs. 5, 6). The branchiostegal membranes, which appear dark in normal folded position, are azure and very conspicuous when fanned out. The oral cavity is milky and the iris is orange.

Females are similarly bicolored on the body but lack any color in the dorsal fin other than scattered dark flecks along the spines and rays. The branchiostegal membranes are dark but not tinted with blue.

Pectoral and pelvic fins are colorless in both sexes but the anal fin is somewhat speckled along the rays.

Three preserved specimens from The Marine Laboratory of the University of Miami (UMML) were available for study; numbers in parentheses refer to the number of specimens and their standard length in millimeters: UMML 2320 (1, 61): dorsal rays XXI + 32, anal rays II + 35, pectoral rays 13-13, striated caudal rays 13. UMML 2376 (1, 73 + one mutilated specimen): dorsal rays XVIII + 34, anal rays II + 34, pectoral rays 13-13, striated caudal rays 13.

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UMML 2319 (1, 67): dorsal rays XIX + 33, anal rays II + 35, pectoral rays 13-13, striated caudal rays 13. These data agree well with counts listed in a recent review of the genus by Böhlke (1957: table III).

Chaenopsis ocellata is known from south-eastern Florida (Biscayne Bay at Miami to the Dry Tortugas) to Cuba. Two specimens (UMML 2377) recently collected in the Virgin Islands may represent an undescribed species.

OBSERVATIONS

Resting Behavior.—In normal resting position the pike blenny lies on the bottom with its body in a sine or simple curve (Plate I, Figs. 2, 3). The head is raised sharply and swung from side to side as other fish or invertebrates attract its interest. The foreparts are slightly elevated and are supported by the pelvic fins. In resting position the dorsal fin is fully depressed, the transparent pectorals are spread, held stationary or fanned slowly and aid in supporting or steadying the body. In its normal habitat, however, it is doubtful whether *Chaenopsis* is often found in the open. Longley & Hildebrand (1941: 275) state that it inhabits tubes which may be built by the fish itself. Walter R. Courtenay, Jr., (personal communication), observed one in a hole under a rock at Soldier Key, Florida.

For more than a month the blennies lived in an aquarium with an ample supply of sand and food. No tubes were constructed nor did the fish make any effort to burrow. Tubes of the terebellid worm, *Loimia medusa* (Savigny), were placed in the aquarium and were immediately occupied by the pike blennies. The blenny would slowly approach the tube and peer directly into the opening, which was about 20 mm. in diameter. The approach was always directly toward the opening, never from the side. If the tube was empty, the dorsal fin was kept depressed and the blenny reversed its position with its head about one-third to one-half of the body length in front of the opening. The body was then drawn up in a series of curves until the caudal fin was about at the level of the tube opening. Entrance into the tube, always tail first, is like the action of a person groping blindly for some object behind him. Here the caudal fin does the groping until contact is made with the tube, at which time the blenny uncurls and slides backward into the tube. This action rarely accomplishes its objective on first try. More often, the blenny ends up tight against the outside of the tube. After a few seconds of rest it suddenly seems aware that all is not well, at which time the entire act, starting with the eye-

ing of the tube entrance, is repeated until the attempt is successful; on one occasion six tries were required. After a first unsuccessful effort the blenny may peer into the tube from the side rather than make an entirely new approach, although this too may be done, especially if the blenny is distracted in the interim.

Although the tubes of *Loimia medusa* are those that appear in the accompanying illustrations, tubes of the onuphid worm, *Onuphis magna* (Andrews), were also used extensively in the later portions of this study, since they are abundant in the pike blenny's habitat. Tube diameters of *Loimia* average slightly less than 20 mm. Those of *Onuphis* are a few millimeters narrower and of more rigid construction. Empty tubes were normally presented but one tube of *Loimia* containing the worm was placed in the tank. A pike blenny evicted the worm, but little importance may be attached to this incident since the tube was lying flat on the sand with both ends exposed. No differences were noted in the behavior of the pike blenny with the two types of worm tubes. Artificial tubes of rubber and glass were employed without success, although one blenny briefly entered a glass tube whose aperture was flush with the substrate.

Sand at one end of the tank was elevated to support the worm tubes (*Onuphis*) in a vertical position. The blennies approached them directly as before but had greater difficulty in backing into them if the openings were more than one inch from the surface of the sand. The ends of the vertical worm tubes encountered in the grassy areas where the blennies were obtained are generally two or three inches above the surface of the sand and are curved so that the angle of the aperture is parallel with the sand, or nearly so. In the same area are broken tubes of various lengths which lie on the bottom. If given a choice of a horizontal or a vertical tube whose aperture is more than an inch above the surface of the sand, the blennies generally chose the horizontal tube. When the vertical tubes were nearly flush with the bottom, no particular preference was indicated. If the tube aperture were high enough to cause the blennies difficulty, they occasionally tugged at the rim with their jaws in an apparent attempt to pull it closer to the substrate.

Resting position in a tube does not vary markedly from that noted above except that the portion of the body within the tube must be straight. Usually the entire head shows and is canted upward. Often the body is extended from a horizontal tube until the pelvic fins are free and can act as braces against the bottom to elevate the body (Plate II, Fig. 7). In vertical

tubes, the blennies still cant their head upward from the horizontal opening at a 30° to 45° angle. Generally the body is extended until the pelvic fins are free, although here they are too far from the bottom to serve as braces.

Respiration by the resting pike blenny is slow and not conspicuous; i.e., the mouth is not gaped and only a small upper portion of the gill opening is utilized. As noted above, the pectoral fins usually are held motionless and braced against the bottom but are fanned, apparently for stability, if the blenny raises off the bottom.

The blennies were never observed to burrow in the sand or to hide under objects. When resting on open sand the fanning pectorals create a broad, shallow depression about the blenny. If the tube entrances are blocked with debris, the blenny will push its head through and reconnoiter for a few seconds. Then it moves farther forward and vigorously fans the pectorals and sometimes also the pelvics. The sand is swept away and larger objects are shoved aside with the snout and side of the head.

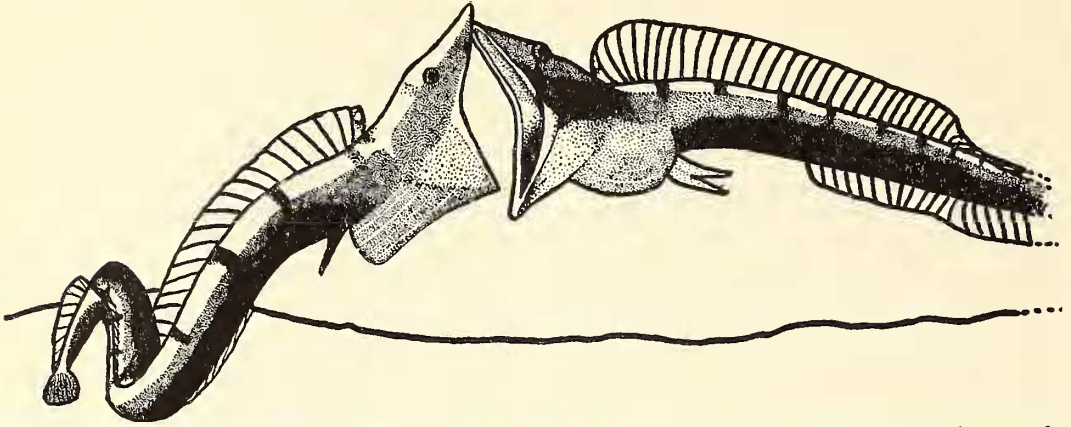
Threat Behavior.—The approach of any animal or even drift material within about ten inches excites the interest of the pike blenny. Its head is raised and the dorsal fin, except for the first several spines, is erected (Plate I, Fig. 2). A slight increase in the respiratory rate is observed and the dorsal fin and head may darken slightly. As the organism drifts by or swims off the dorsal fin is lowered. Closer approach by a second pike blenny results first in the interest behavior noted above and then, if further approach is made, in threat. The transition is marked by a rapid increase in the respiratory rate, an intense darkening of the spinous portion of the dorsal fin and of the head, spreading of the pectoral fins and finally by a wide gaping of the mouth and spreading of the azure branchiostegal membranes (Plate II, Fig. 4). Gaping as an expression of threat is well known in fishes. Walters & Robins (*In Press*) noted differences in coloration of the oral cavity in two species of toadfish. The pike blennies may afford a similar example, for the oral cavity of *C. ocellata* is pale, that of *C. alepidota* black. Threat display is never followed directly by an attack. In most instances, especially where the intruder was smaller, the warning display sufficed to deter its approach. No instance of deferred combat as described by Raney (1947: 127) or Reighard (1910: 1128) for cyprinid fishes was seen in *Chaenopsis*.

The approach of a female pike blenny was usually ignored by the male. The female, according to Longley & Hildebrand (1941: 275)

is readily distinguished by its lower and paler spinous dorsal fin and in details of coloration already described.

The large supralateral eyes of the blenny may be rotated and tilted with remarkable freedom. From its behavior, the writers conclude that this blenny depends largely on sight in its activities.

Attack Behavior.—Continued approach of a pike blenny results in aggressive behavior. Once triggered, the attack is carried to completion even if the intruder is removed. Both blennies exhibit rapid respiration with slight and rapid opening and closing of the mouth. The branchiostegals are slightly spread and the dorsal fin is fully erected. The orange and blue area between the first two dorsal spines is exposed (Plate III, Fig. 11) and by twisting the first two spines laterad of the others this color mark is directed forward and toward the intruder (Plate II, Fig. 6). To this point both blennies show the same behavior except that the intruder does not exhibit the prefatory threat cycle (Plate II, Fig. 4). If the intruder approaches rapidly, the defending male goes directly into attack behavior. The two blennies meet snout to snout and then raise the anterior two-thirds of their bodies well off the substrate, the tails being curled on the bottom for support. The mouths are gaped enormously, in contact with each other, the branchiostegal membranes spread fully and the pectorals fanned rapidly to maintain position (Text-fig. 1). If the combatants are nearly equal in size, the two may rise and fall in combat several times, never losing their oral contact. A smaller male is usually subdued rapidly on the first rising contact, but here it must be noted that a much smaller male, unless it is the defendant, is usually discouraged by the earlier warning display. In the aquarium a small male was forced into combat, a situation that presumably would not occur in nature, by moving one blenny into the territory of the second, usually with a probe or plate of glass. The winning male is the one that suddenly shifts its mouth sideways across the other's and clamps down hard. At this point the defeated male folds his dorsal fin and branchiostegal membranes (Plate II, Fig. 5) and contact is broken as both males drop to the bottom. Immediately the defeated male resumes the normal slow respiratory rate and after a few seconds retreats. The victor maintains rapid breathing and keeps the dorsal erected (Plate I, Fig. 1; Plate II, Fig. 5) but the branchiostegal membranes are folded. No additional attack is made on the defeated blenny even though it may remain nearby for a few seconds. Return to resting behavior on the part of the victor is not accomplished for several



TEXT-FIG. 1. Territorial combat between two males of *Chaenopsis ocellata* Poey. Drawn from a photograph.

minutes, although the color spot in the dorsal fin is covered after a few seconds. Unlike the behavior of other fishes (Raney *et al.*, 1953:99), the defending pike blenny apparently does not have an advantage over the intruder; the winner is determined by size and aggressiveness alone. The pike blenny defending a worm tube is in quite a different position and is seldom displaced by a larger aggressor except as noted later. Attack from the shelter of a worm tube does not differ from that described above. The defending blenny does not completely leave the tube, however, unless beaten. In some instances the defending blenny would be doubled back over the worm tube when fighting off an intruder. A male blenny would tolerate a female in the other end of the tube (i.e., a horizontal tube) since it was long enough to accommodate both. In one instance the second male occupied the other end of the tube for a few moments.

The pike blenny readily abandons its tube when outside pressure is applied. By this method we chased the larger male from his home and allowed the second and smaller male to enter. The original male was then returned to the tank. Although a second and empty tube was available he returned to the original tube and when the second blenny was sighted therein, displayed the attack pattern. The second blenny had retreated into the tube so that only the tip of its snout showed. The attacker raised his body on the pelvic fins, erected the dorsal fin and directed the orange dorsal spot toward the tube opening. The first two or three spines may be twisted to either side in directing the flash spot forward. When the second male made no effort to join the fight, the attacker swam to the tube, the motion being best described as a strike from a coiled position, and very snake-like. Its mouth was opened wide, the tip of the lower jaw on the sand and the upper jaw well above the tube. The

dorsal fin and branchiostegals were still broadly displayed. Next the mouth was clamped suddenly and strongly down over the snout of the "defending" blenny, the action resulting in a partial folding of the branchiostegal membranes. Plate III, Fig. 8, shows the action nearly completed. The defending blenny erupted from the tube, speeded by several snaps of the aggressor (Plate III, Fig. 9), and fled over the tube to the far end of the aquarium. Such rapid swimming is accomplished by anguilliform movements with the vertical fins depressed. After a minute the victor entered the tube, employing the behavior described earlier. In some instances the defending male remained completely in the tube, at which time the attacker yanked several pieces from the tube entrance and pressed its attack into the tube with the same end result.

Other species of fishes elicited varied responses. Two common grass flat inhabitants, *Callionymus calliurus* Eigenmann & Eigenmann, and a species of *Syngnathus* were never attacked or threatened, while juveniles of *Sparisoma*, equally common on the grass flats, were vigorously attacked and snapped at. At no time did they return the fight.

Behavior Before a Mirror.—A pocket mirror was placed in front of the tube occupied by a male pike blenny. The type of response was controlled by the intervening distance and the rapidity with which the mirror was advanced. At 10 inches interest was exhibited. At about six inches, interest gave way to threat. Failure to remove the mirror at this point did not result in attack. Approach to a point somewhat less than the body length of the blenny resulted in attack. Slow approaches were successful in a closer placement of the mirror. A fast approach alarmed the blenny and resulted in immediate attack responses. Attack on the mirror image was violent and since the blenny was evidently

neither victorious nor defeated the attack was repeated many times. Plate III, Fig. 11, shows the initial attack of a sequence in its early phase, Plate III, Fig. 10, a momentary pause before a second attack. The blenny which is in the middle of combat (in this case between repeats) is much darker in dorsal-fin and head coloration compared to the same fish (Plate III, Fig. 10) at the start of combat (see also Plate III, Fig. 8). In combats between two blennies the issue was decided in every instance during the initial attack and repeated attacks did not occur.

Proximity of Tubes and Behavior.—Two occupied tubes were placed in the same section of the tank, both occupied by males of *Chaenopsis*. Again, threat was exhibited at a distance of about six inches. If the tubes are left in this position, threat display usually subsides but may be resumed if one of the blennies moves suddenly. Gradually the two appear to accept the reduction in territory size and threat behavior ceases. Placement of the tubes at a point where the two blennies may easily reach each other results in immediate combat. In one instance the defeated blenny retreated so rapidly into the tube (*Loimia*) that the side was broken out, whereby the vanquished fish escaped.

Obviously the pike blenny is a strongly territorial fish but we can report nothing on its territory size in nature. Efforts to observe pike blennies in the vicinity of Miami where the study material was obtained have not been successful. The concentration of individuals would appear to be very low in the region. Similarly, at Soldier Key where one specimen was collected and a second observed (see above), a large poison station yielded a variety and abundance of small bottom fishes but no pike blennies.

Threat and attack may be elicited by extraneous objects such as a pencil or finger. Attack is not repeated on such objects and after several trials no response will be given for one or several days. The initial attack, however, does not lack in vigor and one blenny was completely raised from the water before loosening its grip.

Spurious Attack.—While photographing the pike blennies, attacks were stimulated repeatedly for an hour or more at a time without diminution of the response though it became more difficult to prod one blenny into the second's territory. The intrinsic factors that control the various responses are apparently maintained at a high level in the male pike blenny and accumulate if no need for their use is forthcoming. A pike blenny kept alone or far removed from another pike blenny may vary its behavior suddenly. Thus its head and dorsal fin will darken periodically and then fade, without any external

stimulus. Attack usually will follow several such changes. Since no fish or invertebrate is near, the attack is directed against some nearby object such as a small stone or merely a nearby point in the sand.

Feeding Behavior.—Feeding was observed and recorded when the blennies were free in a 15-gallon aquarium and when they were in both horizontal and vertical tubes. Any drifting or swimming object elicited interest. At such times the body, if relatively straight at the time, was now curled and the dorsal partly erected (Plate I, Fig. 2). A quarter-inch grass shrimp (*Tozeuma*) was caught by a sudden strike from the semi-coiled position. Shrimp were caught from the side, vigorously clamped and then shifted longitudinally in the mouth, and after several bites swallowed entire. If the grip was not satisfactory the shrimp was spit forward and a fresh grip made. The dorsal flash spot was not exposed, nor were the branchiostegal membranes. Food items never elicit threat display. On one occasion strikes were directed against three small shrimp which swam by above the bottom, and a fourth shrimp which rested nearby on the sand was stalked and caught. The pike blenny will readily leave its tube in catching food. A small mojarra (*Eucinostomus*) about 12 mm. long was caught and eaten and a small piece of ground fish placed nearby was also eaten.

OBSERVATIONS ON *Chaenopsis alepidota* (GILBERT)

A related species, *C. alepidota*, occurs in the eastern Pacific in the Gulf of California. Böhlke (1957: 99-102) recently described a new subspecies, *C. a. californiensis*, from Santa Catalina Island, restricting the nominate form to the Gulf of California. In addition to geographical considerations, two specimens forwarded by Conrad Limbaugh were studied, and the following observations may be allocated to *C. a. alepidota*. Identification of the tubes with *Chaetopterus* is doubtful. The tube diameter is about 20 mm.

Mr. Limbaugh, of the Scripps Institution of Oceanography, has generously permitted the writers to include the following notes recorded by him, Andreas Rechnitzer and Earl A. Murray.

"Small tube fish were observed in tubes off Los Angeles Bay in a protected cove on one of the many small islands located about a mile from the shore during September 1953.

"These slender mottled brown fish occupied parchment-like tubes resembling those of the worm *Chaetopterus*, which protrude from the sand and open toward the surface. A few occupied small holes in the sand. These tubes and

holes were located on a sloping coarse shell and coralline sand bottom in a very protected rocky cove. The bottom was partially covered with short brown algae and scattered outcrops of volcanic rock projected through the sand. The estimated water depth varied between 8 and 16 feet, depending on the tide.

"As a skin diver approached the tube, the fish would withdraw into the tube, but if the diver attempted to cover the tube, the fish would leave and seek another. They entered the tubes or holes tail first.

"Several specimens were captured by placing a glass jar over the tubes. The lengths were estimated to be 3-4½ inches."

Additional observations on *C. a. alepidota* were recorded by Ron Church and Mr. Limbaugh.

"Adult tube fish were observed in tubes off the protected point of San Luis Gonzaga Bay during July, 1956. A group of adults, some in breeding color, occupied parchment-like tubes, possibly those of the worm *Chaetopterus*, which projected above the sloping sand bottom in a very protected area. Some of the occupied tubes extended as much as 3 inches above the substrate. The depth varied between 10 and 18 feet, depending on the tide. The bottom was of coarse sand, much of which was covered by a growth of brown algae.

"The larger fish were brightly marked, but were able to control the intensity of the pattern. They intensified the colors and increased the contrast when they threatened their neighbors or the photographer.

"The threatening behavior consisted of a rapid bobbing up and down while the head was in a horizontal position. The fins and throat were expanded and the mouth with its black interior was held open. Sometimes they would leave their tubes after they had worked themselves into a rage and lock jaws with their neighbors. They would spin a few times and return to their tubes. This same behavior was repeated if one of their neighbors, interested in catching a mysid, wandered into their territory.

"Feeding consisted of snapping up some of the many mysids which swam in clouds over the bottom. Usually the fish merely extended itself to catch one, but sometimes would leave the tube to follow one.

"If the observer covered the tubes with sand, the fish would probe its head through the sand and fan the sand out of the area by a rapid movement of its pectoral which sent the sand forward. Larger pieces of gravel were picked up with the mouth and carried a few inches

away. The tube fish were estimated to range in size between 4 and 5½ inches."

On May 28, 1958, Mr. Limbaugh again checked the population at Los Angeles Bay.

"Adults and sub-adults of *Chaenopsis* were found to be abundant in a bay on the west side of Isla Ventana in the Gulf of California just outside of Los Angeles Bay, Baja California.

"The bottom had changed considerably. It was more cobble than sand and had a healthy growth of plants and other organisms in contrast to the relatively barren sand observed there on my first visit (see above).

"Tube fish were abundant, most of them in parchment-like worm tubes between cobbles but some were swimming free. Several sub-adults were observed fighting. A few adults showed breeding color but no eggs were found in their tubes. One large adult (presumably a female) was very heavy with a swollen yellow belly. The population occurred in depths of about 3 feet to 20 feet."

Examination of color photographs provided by Mr. Limbaugh shows that *C. alepidota* has color markings in the same locations as does *C. ocellata*. Presumably they play similar roles in the behavior of *C. alepidota*. Details of coloration differ markedly between the two species. The spot in the spinous dorsal is located between spines 1 and 2 but is black, narrowly margined above by a pale area which may be orange. Most of the branchiostegal and gular region is black except for the white tip of the lower jaw. The outer corners of the mouth are bright orange whereas the cheek is white except for a dark blotch, about equal in size to the eye, on its posterior portion. The upper branchiostegal region and lower preopercle are bright orange; the color is not continuous with the orange at the corner of the mouth. The orange is set off from the black below, and above, by a well defined white streak. The opercle and postorbital region are largely black, the pigment forming two large blotches, each wider than the length of the snout. The orange projects for a short distance dorsad between the two blotches. The opercular membrane is white.

More detailed observations are needed both of *C. ocellata* and *C. alepidota* to determine whether differences, such as the absence of bobbing behavior in *C. ocellata*, really exist in nature.

SUMMARY

Behavioral observations are described for the pike blenny, *Chaenopsis ocellata* Poey, under aquarium conditions. The species is strongly

territorial and well suited for aquarium study. Resting, threat, attack and feeding patterns are discussed. A multicolored spot in the spinous dorsal fin and the azure branchiostegal membranes play important roles in threat and attack behavior, as does the erection of the dorsal fin, gaping of the mouth and a change in respiration rate.

Some notes are provided for *Chaenopsis alepidota* (Gilbert), a related species from the eastern Pacific, but detailed comparison of the two species is not yet possible.

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EXPLANATION OF THE PLATES

PLATE I

- FIG. 1. A victorious male *Chaenopsis ocellata* Poey immediately after combat. Note the fully erect dorsal fin, the partially folded branchiostegal membranes and the rapid respiratory rate, indicated here by the open mouth.
- FIG. 2. A male *C. ocellata* in resting position on an open sand bottom. The partially erect dorsal fin is evidence of interest in some approaching object or animal.
- FIG. 3. A male *C. ocellata* in normal resting position on an open sand bottom as viewed from above.

PLATE II

- FIG. 4. Threat display by one male *C. ocellata* toward a second approaching male. Note the gaping mouth, the spread and rigid pectorals and the folded anterior portion of the spinous dorsal fin.
- FIG. 5. End of combat between two males of *C. ocellata*. The erected dorsal and open mouth of the fish on the left indicates the victor, the closed mouth and folding dorsal fin of the fish on the right marks the defeated fish, which will shortly move off.

FIG. 6. Combat about to be broken off between two males of *C. ocellata*. Again the folding dorsal fin on the right-hand fish signifies defeat. Note especially the use of the pelvics as a brace against the bottom and the manner in which the dorsal flash spot is directed forward.

FIG. 7. Resting behavior by a male *C. ocellata* in a terebellid worm tube (*Loimia medusa*). The dorsal fin is folded and the pectorals are fanned for stability.

PLATE III

FIGS. 8 & 9. Attack by a male *C. ocellata* on a second male which usurped the tube of the attacking fish during a momentary absence. In Fig. 8 the male is about to bite the snout of the second male and in Fig. 9 the second male is in full flight. Fig. 8 shows the end of a strike from a coiled position.

FIGS. 10 & 11. Behavior of a male *C. ocellata* toward a mirror image. Fig. 11 shows the initial attack display, Fig. 10 momentary pause before a subsequent attack. Note the intense darkening of the head and dorsal fin of the male in Fig. 10 after one attack.